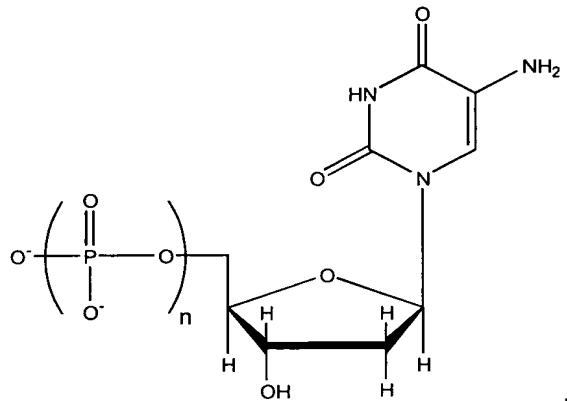


CLAIMS

1. A composition, comprising a structure:



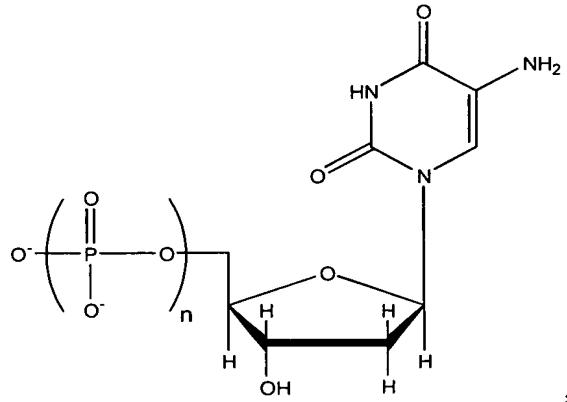
5 wherein n is at least 2.

2. The composition of claim 1, wherein at least one atom is radioactive.

3. The composition of claim 1, wherein a hydrogen atom on a base has been  
10 substituted by an electron-rich group.

4. A method of synthesizing a composition, comprising:  
providing a species comprising a nucleoside; and  
reacting the species with a compound to form a composition comprising a

15 structure:



wherein n is at least 2.

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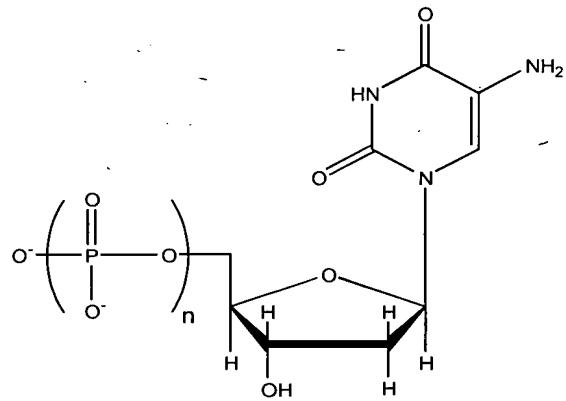
5. The method of synthesizing a composition of claim 4, wherein the nucleoside comprises deoxyuridine.

6. The method of synthesizing a composition of claim 4, wherein the nucleoside 5 comprises a deoxyuridine derivative.

7. The method of synthesizing a composition of claim 6, wherein the deoxyuridine derivative comprises 5-nitro-2'-deoxyuridine.

10

8. A method of synthesizing a deoxyribonucleic acid, comprising:  
providing a plurality of nucleotides;  
providing a composition comprising a structure:



wherein n is at least 2; and

15

reacting the nucleotides and the composition to produce a deoxyribonucleic acid.

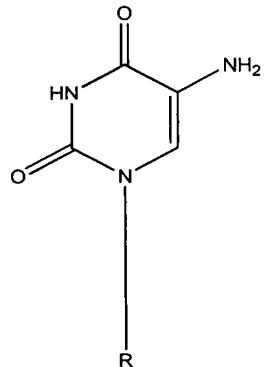
9. The method of synthesizing a deoxyribonucleic acid of claim 8, wherein the step of reacting the nucleotides and the composition comprises reacting the nucleotides and the composition together using a polymerase.

20

10. The method of synthesizing a deoxyribonucleic acid of claim 8, wherein the step of reacting the nucleotides and the composition comprises reacting the nucleotides and the composition in a polymerase chain reaction device to produce the deoxyribonucleic acid.

11. The method of synthesizing a deoxyribonucleic acid of claim 8, further comprising the step of adding additional nucleotides to the deoxyribonucleic acid after the step of reacting the nucleotides and the composition to produce the deoxyribonucleic acid.

5 12. A method of synthesizing a deoxyribonucleic acid, comprising:  
providing a nucleic acid comprising a base at a position within the nucleic acid, wherein the base is one of thymine or uracil; and  
synthesizing a deoxyribonucleic acid using the nucleic acid as a template, wherein a base at a position within the deoxyribonucleic acid corresponding to the position of  
10 the base within the nucleic acid has been substituted by an unnatural base comprising a structure:

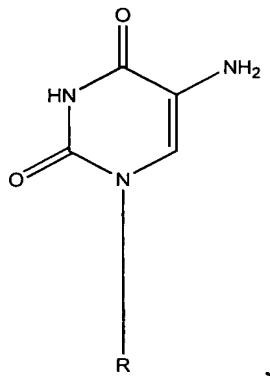


wherein R is a covalent bond.

15 13. The method of synthesizing a deoxyribonucleic acid of claim 12, wherein the step of synthesizing a deoxyribonucleic acid comprises synthesizing the deoxyribonucleic acid within a polymerase chain reaction device.

14. A method of analyzing a deoxyribonucleic acid, comprising:  
20 providing a deoxyribonucleic acid comprising an unnatural base, the unnatural base comprising a structure:

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wherein R is a covalent bond; and

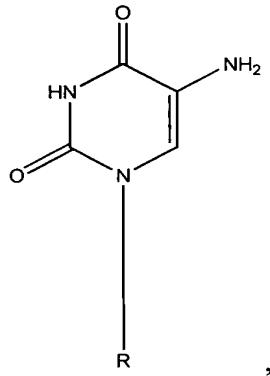
determining a position of the unnatural base within the deoxyribonucleic acid.

5

15. A method of characterizing a compound, comprising:

providing a compound;

contacting the compound with a deoxyribonucleic acid comprising an unnatural base, the unnatural base comprising a structure:



10 wherein R is a covalent bond; and

determining a degree of binding between the compound and the deoxyribonucleic acid.

15. The method of characterizing a compound of claim 15, wherein the compound is a protein.

17. The method of characterizing a compound of claim 15, wherein the compound is a peptide.

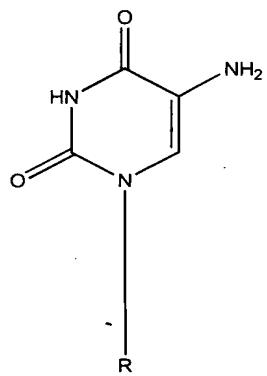
18. The method of characterizing a compound of claim 15, wherein the compound is a nucleic acid.

19. The method of characterizing a compound of claim 15, wherein the compound 5 has a molecular weight of less than about 1000 Da.

20. The method of characterizing a compound of claim 15, wherein determining a degree of binding comprises determining a strength of a noncovalent interaction between the compound and the deoxyribonucleic acid.

10

21. A method of oxidizing a deoxyribonucleic acid, comprising:  
providing a deoxyribonucleic acid comprising an unnatural base, the unnatural base comprising as structure:



15 wherein R is a covalent bond; and

reacting the deoxyribonucleic acid with an oxidizing agent.

22. The method of oxidizing a deoxyribonucleic acid of claim 21, further comprising the step of reacting the deoxyribonucleic acid with an alkaline compound.

20

23. The method of oxidizing a deoxyribonucleic acid of claim 22, wherein the step of reacting the deoxyribonucleic acid with an alkaline compound comprises reacting the deoxyribonucleic acid with an alkaline compound to cleave the deoxyribonucleic acid.

24. The method of oxidizing a deoxyribonucleic acid of claim 21, wherein the step of reacting the deoxyribonucleic acid with an oxidizing agent comprises reacting the deoxyribonucleic acid with a solution comprising potassium permanganate.

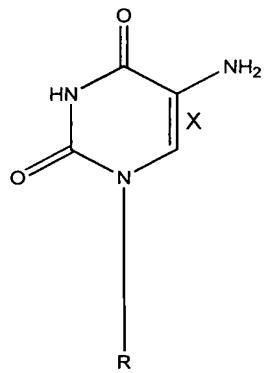
5 25. The method of oxidizing a deoxyribonucleic acid of claim 21, wherein the step of reacting the deoxyribonucleic acid with an oxidizing agent comprises reacting the deoxyribonucleic acid with a solution comprising hydrogen peroxide.

10 26. The method of oxidizing a deoxyribonucleic acid of claim 22, wherein the step of reacting the deoxyribonucleic acid with an alkaline compound comprises reacting the deoxyribonucleic acid with a solution comprising sodium hydroxide.

15 27. The method of oxidizing a deoxyribonucleic acid of claim 22, wherein the step of reacting the deoxyribonucleic acid with an alkaline compound comprises reacting the deoxyribonucleic acid with a solution comprising piperidine.

20 28. The method of oxidizing a deoxyribonucleic acid of claim 22, wherein the step of reacting the deoxyribonucleic acid with an alkaline compound comprises reacting the deoxyribonucleic acid with a solution comprising pyrrolidone.

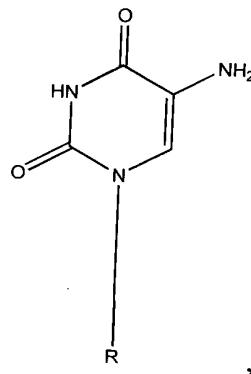
29. A method of oxidizing a deoxyribonucleic acid, comprising:  
providing a deoxyribonucleic acid comprising an unnatural base, the unnatural base comprising a structure:



wherein R is a covalent bond; and

reacting the deoxyribonucleic acid with a compound to cleave double bond X.

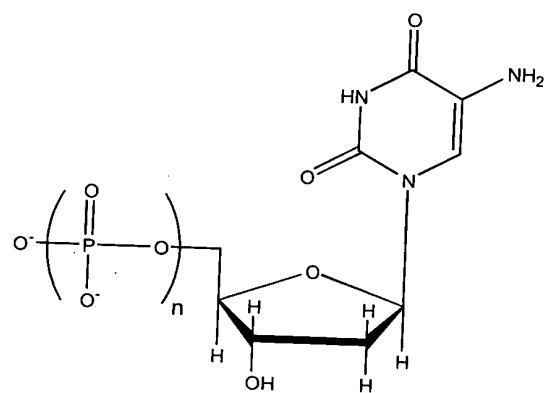
30. A method of oxidizing a deoxyribonucleic acid, comprising:  
5 providing a deoxyribonucleic acid comprising an unnatural base at a position within the deoxyribonucleic acid, the unnatural base comprising a structure:



wherein R is a covalent bond; and

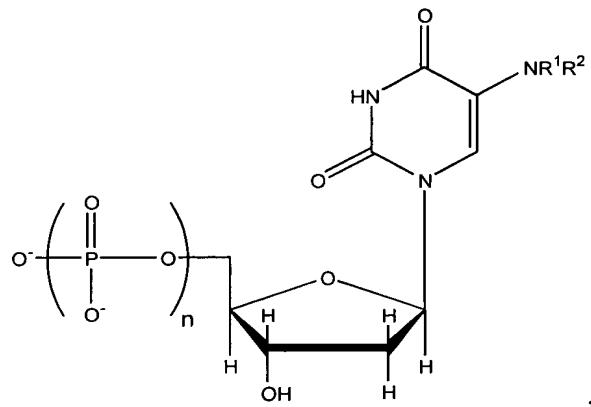
reacting the deoxyribonucleic acid with a compound to cleave the  
10 deoxyribonucleic acid at the position of the unnatural base.

31. A method of synthesizing an amine, comprising:  
providing a composition comprising a structure:



15 wherein n is at least 2; and

reacting the NH<sub>2</sub> group of the composition with a compound to form an amine comprising a structure:

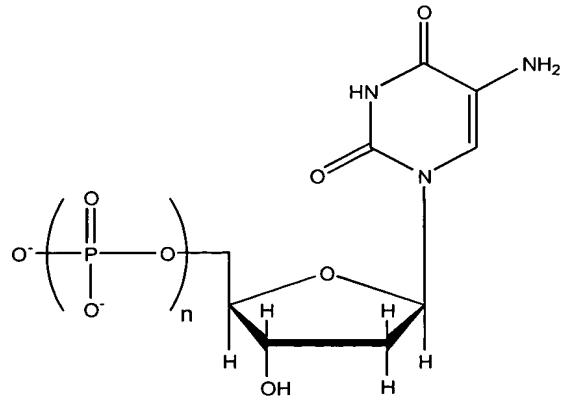


wherein at least one of R<sup>1</sup> and R<sup>2</sup> comprises a carbon atom.

5 32. The method of synthesizing an amine of claim 31, wherein at least one of R<sup>1</sup> and R<sup>2</sup> comprises a fluorescent entity.

33. The method of synthesizing an amine of claim 31, wherein at least one of R<sup>1</sup> and R<sup>2</sup> comprises a radioactive entity.

10 34. A method of synthesizing a compound, comprising:  
providing a composition comprising a structure:



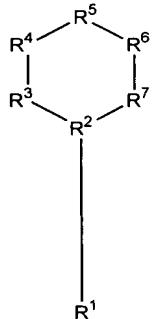
wherein n is at least 2; and

coupling a reporting group to the compound.

15 35. The method of synthesizing a compound of claim 34, wherein the reporting group is fluorescent.

36. The method of synthesizing a compound of claim 34, wherein the reporting group is radioactive.

5 37. A composition, comprising a structure:

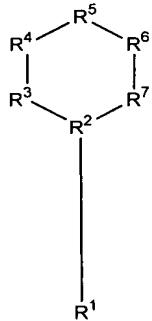


wherein R<sup>1</sup> is capable of being integrated into a nucleic acid; R<sup>2</sup> is a carbon atom or a nitrogen atom; R<sup>3</sup> comprises an atom; R<sup>4</sup> and R<sup>5</sup> are capable of participating in hydrogen-bonding to adenine or an adenine analog; and at least one of R<sup>6</sup> and R<sup>7</sup> comprises an electron-rich substituent.

10 38. The composition of claim 37, wherein at least one of R<sup>6</sup> and R<sup>7</sup> comprises an amine.

15 39. The composition of claim 38, wherein the amine is NH<sub>2</sub>.

40. A composition, comprising a structure:



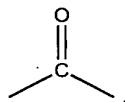
20 wherein R<sup>1</sup> is capable of being integrated into a nucleic acid; each of R<sup>2</sup>, R<sup>3</sup>, R<sup>4</sup>, R<sup>5</sup>, R<sup>6</sup> and R<sup>7</sup> is one of a carbon atom or a nitrogen atom; at least one of R<sup>4</sup> and R<sup>5</sup> is capable of

hydrogen bonding to or carries a substituent capable of hydrogen bonding to adenine or an adenine analog; and at least one of R<sup>6</sup> or R<sup>7</sup> carries an electron-rich substituent.

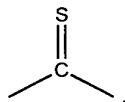
41. The composition of claim 40, wherein at least one of R<sup>6</sup> and R<sup>7</sup> comprises an  
5 amine.

42. The composition of claim 41, wherein the amine is NH<sub>2</sub>.

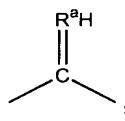
43. The composition of claim 40, wherein R<sup>5</sup> comprises a structure:



44. The composition of claim 40, wherein R<sup>5</sup> comprises a structure:



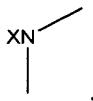
45. The composition of claim 40, wherein R<sup>5</sup> comprises a structure:



wherein R<sup>a</sup> is one of an oxygen atom and a sulfur atom.

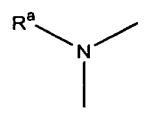
46. The composition of claim 40, wherein R<sup>5</sup> comprises an amine.

47. The composition of claim 40, wherein R<sup>4</sup> comprises a structure:



wherein X is one of a hydrogen atom or a halogen.

48. The composition of claim 40, wherein  $R^4$  comprises a structure:



wherein R<sup>a</sup> comprises a carbon atom.

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